Regional Response Team (RRT) 6 In-Situ Burn Policy for the Offshore Environment

Annex 13

May 2020

RRT-6 Approval Signatures

For the Preauthorized Use of Burning Agents in the Offshore Environment

In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan 40 CFR § 300.910(a), the U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), Department of the Interior (DOI), Department of Commerce (DOC), along with the states of Louisiana and Texas, grant preauthorization to the Federal On Scene Coordinator (FOSC) for the use of burning agents within the offshore environment. The circumstances and conditions pertaining to preauthorized burning agent use may be found within the section titled "***Preauthorized Burning Agent Use and RRT-6 Consultation***" located on page 2. Additionally, there are designated exclusion zones where the use of burning agents and the In-Situ Burn technique are prohibited; these zones may be found in Appendix F.

Disclaimer: The preauthorization component of this policy cannot be finalized and implemented until the U.S. Coast Guard completes the required consultations with the Services (DOI/USFWS and DOC/NMFS). This includes preparation and submittal of a biological evaluation and the receipt of favorable biological opinion. This document will remain unsigned until that process has been completed.

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RRT-6 In-Situ Burn Policy for the Offshore Environment
Table of Contents

Introduction 1

Purpose 1

Authorization Procedures 1

Emergency Situations 2

Preauthorized Burning Agent Use and RRT-6 Consultation 2

APPENDIX A – In-Situ Burn within the Offshore Environment

Decision Making Tools 5

Initial Feasibility Analysis 5

In-Situ Burn Checklist for Preauthorized Areas 6

APPENDIX B – In-Situ Burn Operations Plan 11

APPENDIX C – In-Situ Burn Operational Checklist 14

APPENDIX D – Relevant Best Practices, Protocols, etc.

1. Response Organization – The Incident Command System 16
2. In-Situ Burn Operations 19
3. In-Situ Burn Ignition and Burning Agent Use 22
4. Air Monitoring 24
5. Exposure Limits for Emissions 26
6. Heat Related Hazards 27
7. State of Louisiana Requirements 28
8. State of Texas Requirements 29

APPENDIX E – Post Burn Reporting Requirement 30

APPENDIX F – In-Situ Burn Exclusion Zones 31

APPENDIX G – Deepwater Horizon Lessons Learned 32

LIST OF FIGURES

Figure-1: Burning agent preauthorization process for the Offshore Environment 3

Figure-2: Incident Command System structures to support a small/large in-situ burn operation 17

Figure-3: OSHA PEL for potential in-situ burn hazards 26

In-Situ Burn Policy

Introduction

This document represents the Regional Response Team 6 (RRT-6) in-situ burn policy within the offshore environment and describes the circumstances when the preauthorized use of burning agents[1] in conjunction with the in-situ burn (ISB) technique can be used. Also provided are protocols and best practices for conducting ISB operations in the offshore environment.

Instituting this policy will help ensure a more effective response to oil spills within the Region 6 Area of Responsibility (AOR). Questions, concerns, and recommendations relating to this policy should be addressed to the RRT-6 Co-Chairs.

Note: Ultimately, this policy will supersede the existing RRT-6 In-Situ Burn Plan dated 1994. All provisions of this new *draft* policy can be implemented beginning in May 2020 with the exception of the preauthorization component. Before the RRT-6 can formally approve an updated preauthorization for burning agent use in conjunction with the ISB technique in the offshore environment, the U.S. Coast Guard must prepare and submit a biological evaluation to the Services (DOI/USFWS & DOC/NMFS). The RRT-6 process can proceed toward finalization once the Services provide the U.S. Coast Guard a favorable biological opinion. Until that time, the preauthorization for use of burning agents in conjunction with the ISB technique is covered by the existing RRT-6 guidance document (see RRT-6 Pre-Authorization for In-Situ Burn Part 1).

Purpose

The RRT-6 recognizes that in some instances physically collecting and removing oil may not be possible, thus using burning agents in conjunction with the ISB technique offers the Federal On-Scene Coordinator (FOSC) an effective way to mitigate an oil discharge. By planning for and addressing the potential preauthorized use of burning agents, this policy meets the requirements of Subpart J of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and existing National Response Team (NRT) guidance. It provides direction for the use of burning agents in conjunction with the ISB technique to the predesignated FOSC for discharges of oil which impact or threaten to impact navigable waters within RRT-6.

Authorization Procedures covered by this policy

Offshore. The U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), Department of the Interior (DOI), Department of Commerce (DOC), and the states of Louisiana and Texas have preauthorized the use of burning agents within *offshore environments*. For purposes of applicability, this area is defined as those parts of the Region 6 coastal zone seaward beginning three miles offshore. If the FOSC decides to use the ISB technique within this area, with or without the use of burning agents, this policy will be used. This document **defines the procedures for arriving at the**

[1] Burning agents are defined as "...those additives that, through chemical or physical means, improve the combustibility of the materials to which they are applied." (40 CFR § 300.5)

decision to burn or not to burn and the specific circumstances under which burning agent use is preauthorized.

There are designated exclusion zones within Region 6 where burning agent and ISB use are prohibited; these areas are generally offshore and consist of natural banks, hard bottom habitats, artificial reefs, shoals and an area off of Grand Isle, Louisiana. The specific exclusion zones have been captured in Appendix F of this policy.

RRT-6 does not promote this policy as the sole guidance to be used when making the decision to use burning agents in conjunction with the ISB technique. RRT-6 encourages and expects that FOSCs will seek expert opinions from fire ecologists, practitioners, and/or oil spill ISB experts while coming to this decision. A Unified Command (UC) consisting of federal, state, tribal, and local government, along with the responsible party, will normally be assembled to help the FOSC manage an oil spill response. Although the decision-making process benefits from the support provided by a UC structure, the authority to use burning agents resides solely with the FOSC.

Authorization Procedures for areas not covered by this policy

Coastal. If the FOSC decides to pursue the use of burning agents in conjunction with the ISB technique within the *coastal zone*, see Appendix A of the RRT-6 In-Situ Burn Policy (Annex 13a) for the appropriate authorization procedures (see Annex 13a). For purposes of applicability, this area is defined as those parts of the Region 6 coastal zone extending out to 3 miles offshore.

Inland. If use of burning agents in conjunction with the ISB technique is requested within the *inland zone,* see RRT-6 Regional Contingency Plan Volume 2, Section I for the appropriate authorization procedures (see RCP Vol 2, Section I). For the definition of the Region 6 coastal and inland zone boundaries, please see USCG-EPA MOA.

Emergency Situations

In accordance with 40 CFR § 300.910(d), the FOSC may authorize the use of burning agents when, in the judgment of the FOSC, their use is necessary to prevent or substantially reduce a hazard to human life. Once the threat to human life has subsided, any subsequent burning agent use within the offshore environment shall be in accordance with this policy. Although consultation with the representatives to RRT-6 before using burning agents in these limited instances is not required, FOSCs are still ***strongly*** encouraged to do so.

Preauthorized Burning Agent Use and RRT-6 Consultation

If the FOSC decides to pursue burning agent use in conjunction with the ISB technique within the offshore environment, the chemical countermeasure's preauthorized use is approved. Per 40 CFR § 300.910(a), RRT-6 may specify circumstances under which a burning agent's preauthorized use may occur. For purposes of this policy, ***the preauthorized use of burning agents may be used only after the representatives to RRT-6 have been consulted by the FOSC***. The members to be consulted will be at a minimum the EPA representative to RRT-6 and, as appropriate, the RRT

representative(s) from the state(s) with jurisdiction over the navigable waters impacted or threatened by the discharge, as well as the Department of Commerce and Department of the Interior RRT-6 representatives.

When a FOSC intends to pursue the use of the in-situ burn technique *without* the use of burning agents, RRT-6 ***shall*** still be consulted. In these instances, the FOSC should ***strongly*** consider developing a plan for burning agent use, even when it is believed the chemical countermeasure(s) may not be necessary. Should it be found that burning agent use is needed to achieve ignition, having the conditions of their preauthorized use met in advance ensures the burn operation will not be unnecessarily delayed.

When conducting the consultation with the RRT, the FOSC shall make every effort to provide as much information as possible in advance; this would include providing the completed ISB Checklist for Preauthorized Areas (Appendix A), ISB operations and site safety plans, along with any other briefing materials such as smoke plume models, oil fate trajectories, weather forecasts, etc. Figure-1 outlines the burning agent preauthorization process.

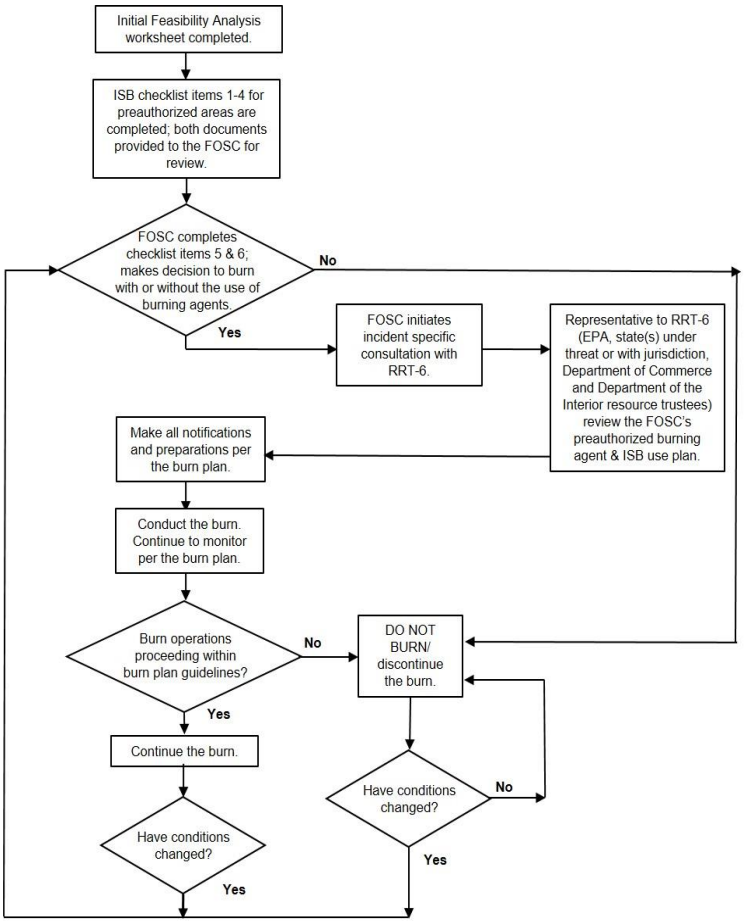


Figure-1: Burning agent preauthorization process for the Offshore Environment.

Decision Not to Burn

If conditions do not support the use of burning agents in conjunction with the ISB technique, the FOSC shall pursue other oil recovery/removal techniques and countermeasure use. Conditions should continue to be monitored in case there is a change which would make burning agent use and ISB appropriate. The FOSC shall ensure that ISB operations do not impact the exclusion zones outlined in Appendix F of this policy.

Post Burn Reporting Requirement

Once burn operations have concluded, the Post Burn Report Form ***shall*** be completed and returned to RRT-6. This form shall be sent by the FOSC, or designated representative, to the Eighth Coast Guard District's RRT-6 Co-Chair and RRT-6 Coordinator via email. The Port Burn Report Form is found in Appendix E of this document. The Eighth Coast Guard District's RRT-6 Co-Chair and Coordinator shall ensure further distribution of the post burn report as appropriate.

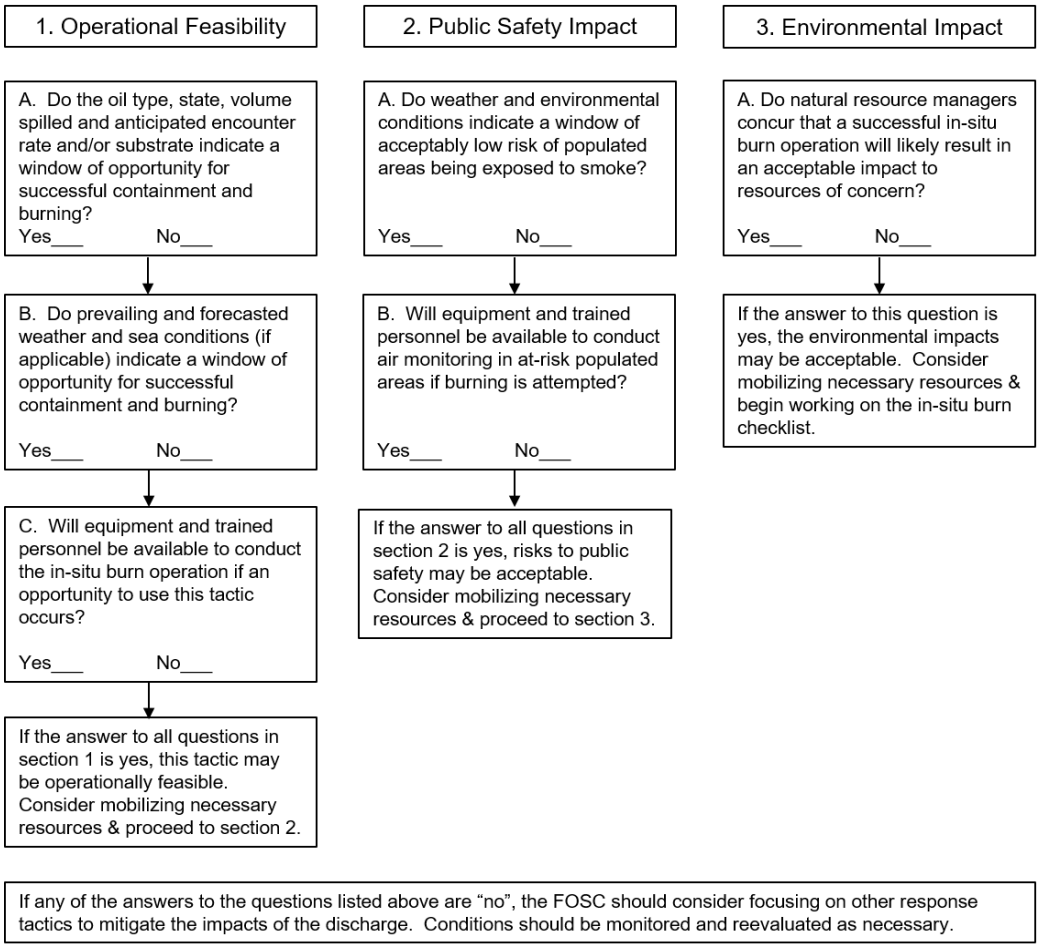
APPENDIX A
In-Situ Burn within the Offshore Environment

Decision Making Tools

The decision-making process begins with a simple preliminary feasibility analysis. If that analysis concludes that an ISB may be feasible, the ISB Checklist for Preauthorized Areas ***shall*** be completed. The ISB checklist is divided into several sections of information about the spill, operational considerations, and resources at risk. When completed, these tools will help identify when a burn may safely occur based on environmental, public health, and operational constraints. It is important to note that even if these tools show that a burn is not a good option, changes in environmental conditions or other factors may make it a feasible option at a later time.

Initial Feasibility Analysis

A feasibility analysis and ISB checklist are provided to help the FOSC organize and analyze information when considering burning agent and ISB use. The Responsible Party, or their designated representative, will work in conjunction with the Unified Command staff to complete these tools.



In-Situ Burn Checklist for Preauthorized Areas

The Responsible Party (RP), or their designated representative, shall work closely with the Unified Command staff to fill in checklist items 1 through 4; once completed, forward to the FOSC for review.

1. Incident Data:

   a. Incident name: _____

   b. Responsible Party: _____

   c. Incident type (grounding, collision, pipeline rupture, well blowout, etc.):
   _____

   d. Date/time of the incident: _____

   e. Location of proposed burn area (lat/long & distance in miles) to nearest land if applicable; and distance in miles to nearest population center):
   _____

   f. Estimated volume (in gallons) of actual discharge:_____

   g. Type of product discharged:_____

   h. Estimated amount (in gallons) of potential discharge:_____

   i. Status of discharge; continuous (rate in gallons/hour), intermittent (rate in gallons/hour), one time discharge, discharge secured:_____

   j. Did the discharged product ignite? (Y/N) If yes, is it continuing to burn? (Y/N)

   k. Develop oil fate model (attach to checklist)

   l. Is the discharge easily emulsified? (Y/N/uncertain)

   m. Has the discharge emulsified? (Y/N) If yes, characterize to what degree: (light (0-20%), moderate (21-50%), heavy (> 51%) or unknown)
   _____

   n. Estimated area (yards/acres/square miles/etc.) of the discharge and description of it in the proposed burn area (e.g., continuous slick, streamers, patches, etc.). Include a date/time for this estimate:
   _____

o. Do the concentrations of oil appear thick enough to burn (>/= 2-3 mm)? (Y/N)

p. Develop oil trajectories (attach to checklist)

q. Forecasted distance from land to the oil at the proposed burn site (reference oil trajectories):_____

r. Expected areas & times at which the discharge will impact the shoreline: _____

s. Distance/direction of closest infrastructure to the proposed burn site (rigs, platforms, well heads, etc.): _____

t. Distance/direction of closest exclusion area or zone to the proposed burn site:_____

2. Forecasted Conditions at the Proposed Burn Site[2]:

a. Air and water temperature (in Fahrenheit):_____

b. Weather (clear, overcast, rain, etc.):_____

c. Wind speed/direction (mph/blowing from):_____

d. Expected transition time between onshore and offshore breeze: _____

e. Water Depth (use feet or meters):_____

f. Surface current (drift): speed _____(knots), direction _____ (degrees true)

g. Sea conditions (calm, light wind chop, confused, etc.):_____
Wave height (in feet): _____
Swell height (in feet):_____

[2] Weather should be continuously monitored to ensure that conditions allow for the safe conduct of ISB operations. The National Weather Service (NWS) can provide incident specific, local spot weather forecasts upon request. To contact your local or regional NWS office, see NWS Link.

3. Resources at risk:

   a. What are the specific aquatic resources at risk from the spilled product? Describe what the species are and the current strategies being implemented to protect them:

   _____

   b. If model/oil trajectories show the spilled product making landfall, what are the specific terrestrial resources at risk? If landfall is not projected, answer "N/A". If landfall is projected, describe what the species are and the current strategies being implemented to protect them:

   _____

   c. What is the estimated time of impact to the resources listed in 3a & 3b? (if resources are already impacted, list the time impact occurred):

   _____

   d. Does it appear that an in-situ burn operation will likely achieve the desired environmental benefit for these identified resources? (Y/N)

   e. Are there any specifically known resources in the proposed burn area that would be negatively impacted by an in-situ burn operation? (Y/N) If yes, describe what they are and whether the impact to them is anticipated to be great enough to offset the benefit to the resources listed in 3a & 3b:

   _____

4. Window of opportunity:

Fill in the top of the sheet based on the period of time an ISB operation is being considered (e.g., if considering commencing a burn at 0800, fill in hour 1 time block with 0800, 0900 for the hour 2 time block, etc.). For each worksheet item, mark either Yes (Y), No (N), or N/A under each time segment. The likely window of opportunity exists for those time segments where none of the items have a "N".

Feasibility Factors	**Hour 1** (time)	**Hour 2** (time)	**Hour 3** (time)	**Hour 4** (time)
Operational Outlook				
1. Oil thickness >/= 2-3 mm				
2. Oil emulsion </= 25-50%				
3. Wind Speed </= 25 mph				
4. Wave height </= 3 feet				
5. Ocean current </= .75 knots				
6. Visibility >/= 500 ft vertically & >/= 0.5 mile horizontally				
7. Trained personnel on-scene & ready				
8. Equipment on-scene & ready				
Planning Concerns				
9. Operation poses acceptably low risk to populated areas				
10. Burn poses acceptable risks to those resources likely impacted				
Public Safety Concerns				
11. Air monitoring equipment and personnel are deployed and standing by (see Appendix D for more details)				
Amplifying Feasibility Factor Information (provide as needed):				

The FOSC shall review items 1 through 4, complete items 5 and 6, then sign and date the checklist in the signature block below. If the FOSC makes the decision to conduct an ISB operation, with or without the use burning agents, the Initial Feasibility Analysis worksheet and this completed, signed checklist shall be forwarded to RRT-6 prior to the consultation.

5. FOSC evaluation of response options:

   a. Will the ISB technique, with or without the use of burning agents, likely mitigate the negative impacts created by this discharge? (Y/N)

   b. Will the use of the ISB technique interfere with (or in any way reduce the effectiveness of) mechanical recovery efforts and/or other potential chemical countermeasure applications? (Y/N)

      If yes, do the potential benefits of burning outweigh the potential reductions in effectiveness of mechanical/other countermeasure applications? (Y/N)

   c. Can the ISB technique, with or without the use of burning agents, be used safely and with an anticipated overall reduction to the negative impacts created by this discharge (when compared with a decision not to burn)? (Y/N)

6. FOSC's decision to pursue the use of burning agents and the ISB technique:

   a. _____ Neither burning agents or the ISB technique will be used.

   b. _____ The ISB technique may be used, but burning agent use will not be authorized.

   c. _____ The preauthorized use of burning agents in conjunction with the ISB technique is approved, with the following conditions:

      _____

   d. _____ The preauthorized use of burning agents in conjunction with the ISB technique is approved.

Signature of FOSC: _____

Printed name of FOSC: _____

Date & time: _____

APPENDIX B
In-Situ Burn Operations Plan

Requirements
Once the decision to pursue the use of burning agents has been made, the RP will be required to submit an ISB operations plan and a site safety plan for review and concurrence by the FOSC. These plans will allow for safe, controlled operations and serve to reduce the risk of exposing response personnel and members of the public to the hazards associated with ISB operations.

In-Situ Burn Operations Plan. The ISB operations plan will vary in complexity depending upon the size and scope of the operations being planned. An ISB operations plan should, at a minimum, contain the following elements: a description of the proposed burn site and locations of response resources, a description and current status of the discharge, vessel and aircraft traffic management plans, oil collection and concentration plan, ignition plan, fire monitoring and fire suppression plan, response organization and communications plan, forecasted weather at time of projected burn, ingress/egress routes and responder evacuation plan, observer locations, air monitoring plan, aerial/on-water assessment plans, and post burn residue recovery and disposal plan. Additional elements not mentioned here should be added as the situation dictates.

Site Safety Plan. The site safety plan will be a site-specific document and should, at a minimum, contain the following elements: health and safety hazard analysis for each site task or operation, comprehensive operations work plan, simultaneous operations plan, personnel training requirements, PPE selection criteria, site-specific occupational medical monitoring requirements, air monitoring plan, site control measures, and pre-operations commencement health and safety briefing for all participants.

Template. The following template may assist in the completion of the In-Situ Burn Operations Plan:

a. Distance of proposed burn site from source of the discharge:
_____

b. Distance of proposed burn site from nearest point of land:
_____

c. Distance (in miles/yards) of proposed burn site from the nearest: Commercial and recreational fishing area:_____
Channel, canal or other vessel traffic lane:_____
Maritime infrastructure (platforms/rigs/pipelines/etc.):
_____
Other response/oil recovery activities: _____

d. Describe the measures being used to reduce/eliminate the risk of the areas/locations outlined in the paragraph above from being impacted by the projected smoke plume:

_____

e. Describe the methods being used to notify mariners and aircraft pilots of the proposed burn operation:

_____

f. Describe the methods being used to control/limit vessel and aircraft traffic in the vicinity of the proposed burn operation, its projected smoke plume and other simultaneous operations (Safety Zones, Temporary Flight Restriction, etc.):

_____

g. Distance (in miles) and name of the nearest population center:

_____

h. Describe all the planned methods of ignition and categorize each as primary, secondary, etc.:

_____

i. Describe the methods for deploying each of the ignition systems outlined in the paragraph above:

_____

j. Do any of the ignition systems employ aviation resources? (Y/N) If yes, has the FAA granted approval for their use? (Y/N)

k. Describe the type and amount (gallons or pounds) of burning agents being planned for:

_____

l. Describe the method(s) for keeping the oil contained during the burn (attach diagrams if necessary):

_____

m. Estimate the total amount of oil to be burned (in gallons):

_____

n. Estimate the time for each planned burn:

_____

o. Describe the air monitoring plan:

_____

p. Develop smoke plume trajectory. (attach to checklist)

q. Develop site safety plan. (attach to checklist)

r. Describe the method for collecting the burned oil residue:
_____

s. Outline the storage and disposal plan for the burned oil residue:
_____

APPENDIX C
In-Situ Burn Operational Checklist

In-Situ Burn Operational Checklist
This internal checklist is to be completed by the FOSC or their designated representative before the start of the burn. It should be used to confirm that all critical conditions, concepts, personnel and equipment necessary for the operation are in place and ready to go, prior to the initiation of the burn.

Approval and Notification Considerations

1. _____ ISB checklist completed and approved by FOSC.

2. _____ RRT-6 consultation conducted.

3. _____ Additional permits/approvals requested and granted by appropriate federal and state agencies/stakeholders (if applicable).

4. _____ U.S. Coast Guard prepared to broadcast Notice to Mariners for proposed burn area(s).

5. _____ Federal Aviation Administration (FAA) prepared to broadcast Notice to Airmen for proposed burn area(s); Temporary Flight Restriction(s) issued.

6. _____ Notifications of the proposed burn area(s), time of the burn(s) and of any transit restrictions have been made to the public and to officials of the local and regional governments.

7. _____ State or local emergency service groups notified and standing by to assist/coordinate responder evacuation efforts.

Operational Requirements

1. _____ Oil is of sufficient thickness, and in sufficient condition, to support burn operations.

2. _____ Vertical and horizontal visibility is sufficient to observe burn operations from the platform(s) assembled (vessel, aircraft, etc.).

3. _____ A sufficient amount of daylight remains to initiate burn operations.

4. _____ Risk mitigation measures have been implemented to reduce/eliminate the threat from smoke plume impacts and unintended fire spread.

5. _____ Burn operations will ***not*** adversely impact the following: mechanical recovery activities, spill source stabilization actions, salvage/marine firefighting efforts or use of other chemical countermeasures.

6. _____ Trained and qualified personnel have been mobilized and are standing by to support the operation. All personnel have been provided safety and position specific briefs and are familiar with their responsibilities.

7. _____ All the response and support equipment/vessels necessary to conduct the operation have been mobilized and are standing by.

8. _____ All necessary personal protective equipment has been issued to response personnel.

9. _____ Dedicated lines of communications have been established for air-to-air, air-to-surface, vessel-to-vessel, and general command and control. All response and support personnel have been provided with primary means of communication. Secondary and backup lines of communication have been established.

10. _____ All required plans (site safety plan, ISB burn plan) have been developed and approved. These plans have been reviewed by those responsible for executing them.

11. _____ All administrative controls and protocols have been established and are in place (Level of Concern (LOC), 10μm particulate matter (PM_{10}) action levels, etc.).

12. _____ All federal and state agencies/stakeholders post burn residue recovery requirements have been established.

APPENDIX D
Relevant Best Practices, Protocols, etc.

1. Response Organization – The Incident Command System

The effort to conduct an ISB operation will be organized under the principles of the Incident Command System. The specialized functions and resources required for an ISB operation should be clearly captured in an Incident Action Plan (IAP). The IAP should be approved for the operational period in which the ISB operations are being conducted and will, at a minimum, contain all of the elements found in the RP's ISB operations plan. If the ISB operations plan was created as a separate document, it is acceptable for the IAP to incorporate it by reference.

The resources required to conduct an ISB will depend on a number of factors. These include the size of the discharge and its current state (heavily weathered vs. freshly spilled), the location of the ISB operation (nearshore vs. deep offshore), the status of the spill (continuous release vs. one-time discharge), the weather conditions on-scene, etc. The tactics for smaller, less complex ISB operations will generally require single resources and/or task forces which will be organized under an ISB Group; this group supervisor, often referred to as the "Burn Boss", reports to the Operations Section Chief.

More complex incidents will require a greater number of resources; to maintain appropriate span-of-control in the Operations Section, the use of a Recovery & Protection Branch and an Air Operations Branch may be required. These Branch Directors will report to the Operations Section Chief. Any aviation resources, such as those used as ignition platform (helitorch) or those used to monitor the ISB operation, will be assigned and operate under an Air Operations Branch. Figure-2 outlines two examples of ICS organizations which could be created to support a small and a large ISB operation. (Note: These diagrams are meant to highlight some of the organizational elements within the Unified Command structure unique to an ISB operation, and not intended to illustrate each ICS function/position available to a Unified Command.)

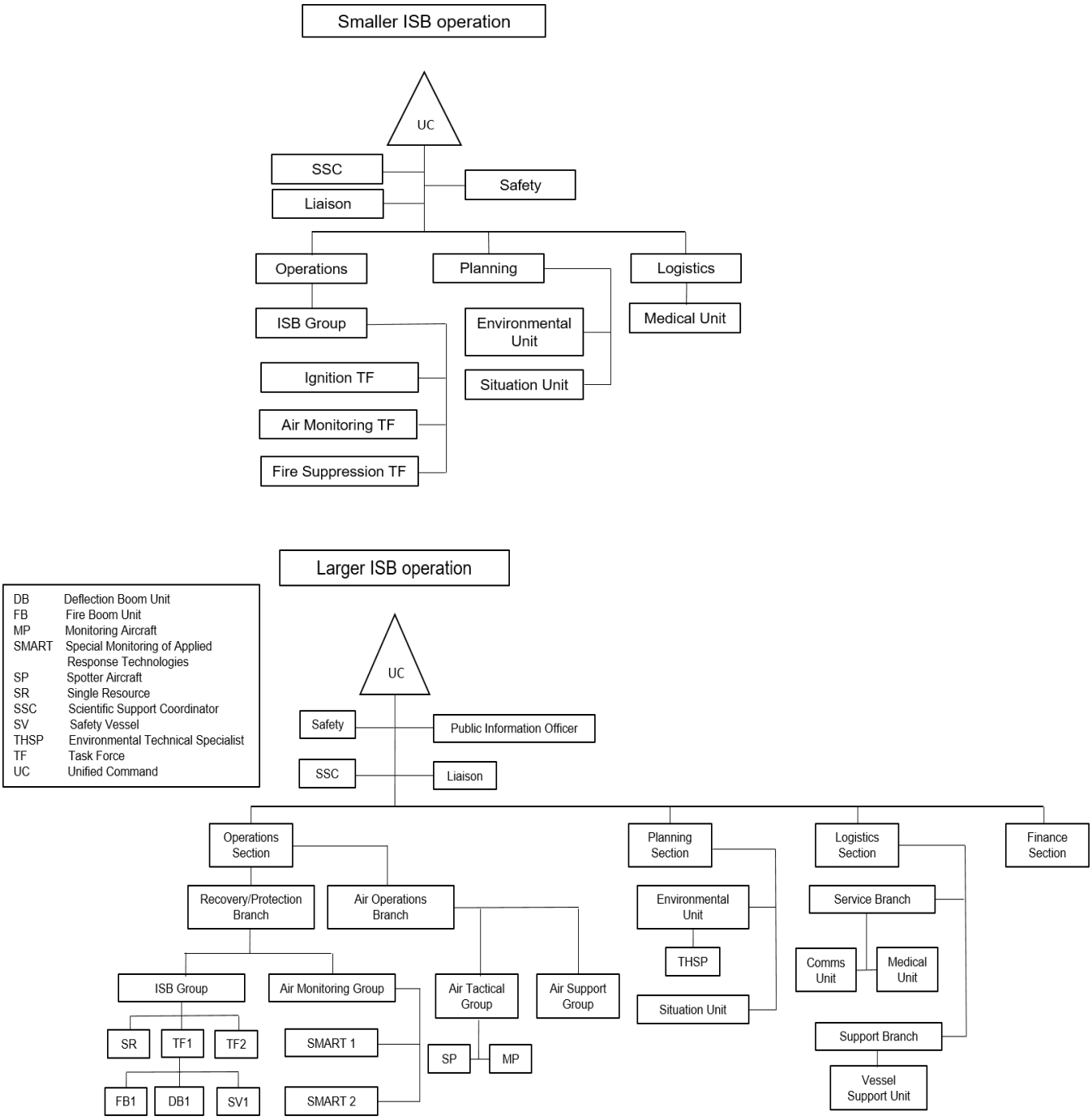


Figure-2: Incident Command System structures to support a small/large in-situ burn operation.

Although the exact composition of a Unified Command organization will vary incident to incident, these critical positions are generally going to be filled during an in-situ burn operation.

Burn Boss/Fire Boss. This member can serve formally as the ISB Group Supervisor or can be designated to work directly under the group supervisor. The Burn Boss is responsible for determining the following: the type of ignition pattern needed to accomplish the proposed ISB, when the ignition should occur and where fire suppression crews should be placed to prevent accidental fire spread. This position is generally given complete authority over the tactics of the ISB and develops the operation's ignition procedures, performs the initial briefing of the burn plan and covers the tactical assignments with each task force leader (and/or pilot if using an aerial ignition system). This person also directs the ignition task force during the burn's ignition sequences.

Ignition Team (Ignition Task Force). This task force's primary function is to introduce burning agent (if being used) and the ignition source into the burn area under the direction of the Burn Boss. Once the burn's ignition requirements have been met, the task force will standby to reignite if necessary. This task force may also serve as a secondary fire suppression crew or be made responsible for tending the fire boom if a team has not been specifically designated to do so.

Fire Suppression Crew (Fire Suppression Task Force). This task force is responsible for patrolling downwind of the fire looking for spot fires or any other unintended spread of the fire; should they find any, they are to put them out. The Burn Boss will generally provide a patrol area where the greatest risk of unintended fire spread exists; however, the task force remains poised and prepared to suppress fires wherever they should occur. As a general practice, should the Fire Suppression Task Force find a spot fire outside of the planned burn area, all further ignition is halted until it is brought under control and the reasons for its development are evaluated.

Air Quality Monitoring Team(s) (Air Monitoring Task Force/Group). These personnel collect visual and air quality data at locations specified in the burn plan and as directed during an ISB operation. The task force will follow the Special Monitoring of Applied Response Technologies (SMART) protocols and can be staffed by members of the USCG National Strike Force (NSF) or other qualified non-NSF individuals. During a burn, they maintain communication with the Burn Boss and with the incident command post, relaying visual burn information as well as analytical data; data is typically in the form of particulate readings and measured vapor levels. This task force may also be tasked with collecting long-term samples and is responsible for the safety at each of the designated monitoring sites.

2. In-Situ Burn Operations

The following environmental and operational planning considerations should be used when preparing for an ISB operation. The goal is to assist the FOSC in developing a thorough and complete burn plan, and to ensure that the ISB operation is conducted safely.

Environmental Considerations:

Winds. In general, sustained winds over 25 mph can make ignition of a discharge difficult as oil can quickly weather and emulsify to a point beyond a combustible state. Preferred conditions would have winds under 20 mph and blowing in a direction favorable to the safety of the public, maritime traffic and responders. Gusting winds over 35 mph can make fire control difficult and increase the risk of unintended fire spread; an ISB under these conditions should be approached cautiously.

Atmospheric Stability. The tendency of the air to resist or enhance the vertical motion of a smoke plume is termed stability. Atmospheric stability plays a key role in how robustly (or weakly) an ISB's smoke plume dissipates; increased turbulence within the atmosphere generally means unpolluted air is being mixed in, and hence diluting, an ISB burn's plume. Air which has been warmed by incoming solar radiation will rise, creating thermal updrafts which are favorable to carrying smoke up and away. The conditions most favorable for an ISB are those where there is strong incoming solar radiation (daylight hours where the sun is greater than 15 degrees above the horizon), and where the winds are low. Under low wind and strong thermal updraft conditions, a plume can rise high into the air greatly reducing the risk of surface exposure to particulates. Burning is generally not advised at night, near dawn/dusk, or on exceptionally overcast days with no wind; under these conditions, the potential for smoke to linger near the surface is greatly increased.

Oil thickness. In order for an on-water discharge to generate sufficient vapors capable of sustaining combustion, oil generally needs to be corralled or contained to a thickness of at least 2-3 mm. Heavier and more emulsified oils may require concentration to thicknesses of 10 mm or more in order to create burnable vapor concentrations.

Wave height. For those burns taking place on-water, wind waves should generally be below 3 feet; preferred conditions would have these being as calm a possible. Attempting to conduct an ISB operation on-water demonstrating an energetic or choppy surface should be approached cautiously. The less agitation a discharge is subjected to, the lower the chance it will mix with water and greater the chance it will sustain combustion.

Emulsification. In order to sustain combustion, oils should typically be less than 25% water content (emulsified); if a discharge appears to be over this amount, a test burn can be conducted to see if the product is capable of burning. For open water

discharges the rule of thumb is the more emulsified an oil, the harder it becomes to burn, requiring larger amounts of burning agents to initiate ignition and sustain combustion.

Currents. Conducting an ISB operation in an area subject to strong currents presents an enormous challenge. Currents will degrade the performance of most containment boom; those currents above 0.75 knots moving perpendicular to boom corralling a discharge are strong enough to cause entrainment. Entrainment is when oil escapes the boom by being forced under by the current, regardless of the depth of the boom's skirt. At currents above 1 knot, boom will lose oil at a very high rate.

Visibility. In general, visibility should be sufficient enough to allow for visual observations of the burn site by those vessels and aircraft supporting monitoring for wildlife (marine mammals, turtles, birds, etc.) and the other aspects of the burn operations. A burn should not be conducted if the visibility is poor or if forecasts call for a significant reduction in visibility due to weather.

Operational Considerations:

Collection and Containment. When planning an ISB operation in an open water environment, the collection and containment of the spilled oil is generally required. Water can act as a heat sink for oil, cooling it and confounding the efforts to achieve ignition; to overcome this, oil must be concentrated enough to allow for vapor production that will support ignition and sustain the burn.

Fire Boom. Fire resistant boom is often used to consolidate oil and keep it contained while burning. For incidents where the oil has caught fire and is burning in an uncontrolled way (i.e. not an ISB operation), this boom can also be used to keep burning oil from igniting nearby structures or from migrating into environmentally sensitive areas.

The two main requirements of fire boom are to provide oil containment and to resist fire damage. Resistance to fire damage is created through either active or passive means. Fire resistance is created passively by using materials such as layers of ceramic fiber and/or stainless steel mesh to surround a glass or ceramic-foam core in the boom. Fire resistance may also be achieved by using stainless steel sheet metal in the construction of the flotation chamber and for all other above-water components.

The active method for achieving fire resistance consists of pumping water (or some other coolant) through the boom to cool exposed surfaces. Some boom designs in this water cooled category have relied on water simply being wicked into a protective layer, but the more common approach is to actively pump water, usually through a hose from one of the boom towing vessels or a support vessel, into a cover protecting the boom.

Fire boom (of either passive or active construction) is generally more fragile and has a lower reserve buoyancy than conventional inflatable containment boom. This makes

some fire resistant boom more susceptible to damage during transport and more likely to lose oil when exposed to excessive wind, waves, or currents. Also, most fire boom will become brittle or damaged when exposed to the intense heat of an ISB. There is recognition that many fire resistant booms have a limited life when used during actual fire operations. A large ISB operation that has many burns will most likely need to have replacement fire boom available.

Fire Boom Deployment. During most on-water ISB operations, spilled oil will need to be concentrated in order to achieve the thickness necessary to burn. A commonly used technique to achieve this involves the use of fire boom towed by two vessels in a catenary, or "U" shape, and towed at speeds near 3/4 knots. To avoid exposing the vessels' crews to excessive heat during a burn, the vessels should rig towlines to create a distance of at least five fire diameters from the nearest flame perimeter. Also, vessel crews will need to ensure that the strength of towlines can withstand the maximum anticipated forces created by the drag of the fire boom. Due to the weight of materials used to create fire resistance, the weight per unit length for fire boom is generally much higher, and the buoyancy-to-weight ratio much lower, than for conventional booms of a similar size. Fire boom's lower buoyancy-to-weight ratios also mean that they will generally not perform well in a high sea state.

Boom Towing Vessels. Prior to ignition of the burn, the towing vessels should be positioned upwind or crosswind from the now collected and concentrated oil slick. If response operations are taking place at or near the source of the spill, extreme caution should be exercised to eliminate the risk of an unintended ignition of oil near or within the source. Once ignition of the collected oil has taken place, proper attention needs to be given by the vessel operators to the condition of the burn, the speed and position of the towing vessels in relation to other ongoing operations, vessels, slicks, etc. The towing vessels must follow the established communications plan and have a predetermined plan of action for emergency situations and for the termination of the burn.

Surface Collecting Agents. One additional oil collection and containment tool available to the FOSC are surface collecting agents (commonly referred to as herding agents). These chemical countermeasures are applied around the periphery of an on-water oil spill, limiting its ability to spread and therefore decrease in thickness. If the FOSC wishes to utilize this countermeasure, they must first seek RRT-6 concurrence as their use has not been preauthorized. In addition, the FOSC will need to ensure that the agent is included on the EPA National Contingency Plan Product Schedule. (see NCP Product Schedule)

Post Burn Residue Recovery. Following the completion of an ISB operation, every attempt should be made to collect and properly dispose of the burn's residue. On-water residue recovery can be accomplished through the use of nets, skimmers, sorbent materials and manual tools. The FOSC ***shall*** consult with federal and state agencies/stakeholders to determine if any post-ISB residue recovery requirements should be implemented or are even feasible.

3. In-Situ Burn Ignition and Burning Agent Use

In order to have fire, certain conditions must be met. These conditions include the presence of an oxidizing agent (oxygen), an uninhibited chemical chain reaction, fuel, and a source of ignition (heat). For an ISB, oxygen is generally provided by the surrounding air and the uninhibited chemical chain reaction will be in place once the fire "gets going" and no longer requires an external source of ignition. The fuels for an ISB are provided by the vapors from the oil and, for those spills with impacts inshore or on land, any other organic materials with which the oil may have come into contact. The methods and equipment used to provide the heat and ignite a burn can vary widely; they can be something as simple as a match or something as complex as a helicopter-based torching device. Often, sources of ignition will rely on the use of burning agents, defined by the NCP as ***"…those additives that, through chemical or physical means, improve the combustibility of the materials to which they are applied."*** Use of burning agents in conjunction with the ISB technique in a non-preauthorized area and/or non-emergency situation must first seek RRT-6 concurrence. The following information is designed to help a FOSC determine if an ignition source is utilizing a burning agent or not.

Not considered burning agents: matches, road flares, marine flares, hand held compressed gas torches (propane, butane, etc.), or any other flame producing devices used to ignite a discharge.

A few examples of these include:

(Road or marine flare)

(Hand held propane torch)

(Lit match)

(Flare Gun)

Considered burning agents: any fuel additive (gasoline, diesel, organic peroxides, flammable metals, etc.) in any state (gelled, liquid, powder, solid, etc.) which is physically introduced, added, or placed into a burn area in order to improve the ignition of a discharge.

Some examples include:

(Container w/ diesel fuel and marine flare)

(Hand held drip torch)

(Container w/ diesel fuel and marine flare)

(Helitorch dispensing gelled diesel)

(Potassium permanganate w/ ethylene glycol)

(Gasoline soaked rag)

There are many other improvised or commercially produced methods/means for initiating a burn available to a FOSC. Regardless of the exact type of device or technique ultimately used to ignite a burn/deploy a burning agent, the specific details and tactics of the ignition process shall be detailed in the ISB operations plan.

4. Air Monitoring

Air monitoring is an important component of any ISB operation. These measurements allow the FOSC to continuously evaluate air quality data ensuring that human health and safety are safeguarded in real-time. Typical by-products from an in-situ burn include carbon dioxide, water vapor, soot (particulate matter), and other gaseous compounds. Of these, the soot, being comprised of very fine, carbon based materials, are responsible for a smoke plume's dark/black appearance and pose the greatest inhalation hazard.

Protocols. To protect against this inhalation threat, the USCG has adopted the use of the Special Monitoring of Applied Response Technologies (SMART) protocols (Special Monitoring of Applied Response Technologies; (SMART) series, Vol. 8, 2006) (see SMART Protocols); FOSCs shall ensure that all air monitoring objectives are aligned with these protocols. SMART protocols can be performed by National Strike Force personnel who may fill the Air Monitoring Task Force/Branch positions under the Operations Section. Since ISB operations can be time sensitive, the FOSC is ***strongly*** encouraged to request NSF support as early as possible. Air monitoring services may be provided by non-NSF personnel capable of meeting the SMART protocols. Those CG members conducting air monitoring shall adhere to the Special Monitoring of Applied Response Technologies (SMART) Tactics, Techniques, and Procedures (TTP) found in CGTTP 3-75.1.

Measures and Timelines. Prior to a burn, monitoring personnel should deploy aerosol monitors, laptops and GPS units to collect and record air quality readings. These readings should include high/low and time-weighted averages for particulate matter (PM) having diameters of 1, 2.5 and 10 micrometers (expressed as PM_1, $PM_{2.5}$ and PM_{10} respectively) as well as other hazards (lower explosive limits, volatiles, poly aromatic hydrocarbons, etc.). Air monitoring operations will require the deployment of one or more monitoring teams; the exact number of teams will depend upon the location and size of the burn, the prevailing winds/atmospheric conditions, plume trajectory or modeling outputs, the location of population centers/critical infrastructure, and input from state and local health officials. After the monitoring areas have been identified, the monitoring teams should deploy and begin set up at the direction of the Burn Boss or Air Monitoring Group Supervisor/Branch Director. The teams will need to take baseline readings typically one hour prior to the start of operations to determine ambient concentrations of particulates in the air. During the burn, sampling should be continuous and readings recorded electronically by the aerosol monitor unit and manually in the team's data log. In addition to the electronic air monitoring, visual monitoring should also be conducted for as long as the burn is taking place. Roughly 20-30 minutes after the burn has concluded and the smoke plume has dissipated, teams will take one final post-operation reading of ambient particulate concentrations.

Level of Concern (LOC). While the air samples are being taken, it is expected that the moment to moment particulate readings will vary widely. The time-weighted averages

being calculated by the aerosol monitor will be less variable and are considered a better indicator of the particulate concentration trend. The LOC for SMART operations follows the National Response Team (NRT) guidelines. The NRT guidelines recommend a conservative upper limit of 150 µg/m^3 of air, averaged over one hour. Furthermore, the NRT emphasizes that this LOC does not constitute a fine line between safe and unsafe conditions, but rather should be used as a trigger to heighten awareness and focus on the particulate levels. If the 150 µg/m^3 of air, averaged over one hour is exceeded substantially, human exposure to particulates ***may*** be elevated to a degree that would justify additional, precautionary action. If PM_{10} levels remain generally below this recommended limit with few or no spikes above it, there is generally no reason to believe the population is being exposed to particulate concentrations above the EPA's National Ambient Air Quality Standard (NAAQS). For the sake of comparison, the EPA's established NAAQS for PM_{10} is 150 µg/m^3 of air averaged over a 24 hour period.

To ensure that the most conservative approach to health and safety is taken during an ISB operation, the FOSC shall ensure that PM_{10} action levels above the NRT recommended LOC are established for each monitoring location and captured within the approved Burn Plan. This includes, but is not limited to, establishing PM_{10} action levels for the following: Shelter in Place, Evacuation (non-essential personnel), Evacuation (all personnel), Fire Suppression Task Force action (don gear, approach site, extinguish fire), etc. The FOSC should consult with Technical Specialists, the NOAA SSC and state and local health officials when establishing these additional PM_{10} action levels.

Information Flow and Data Handling. Communication of the real time monitoring results should flow from the monitoring teams to those persons within the UC who can interpret the results and use the data to initiate action. Typically, the teams in the field will report data on some predetermined schedule to the Burn Boss/ISB Group Supervisor/Branch Director, who will then forward to the Technical Specialist (THSP) found in the Environmental Unit as well as to the Scientific Support Coordinator (SSC). The THSP and SSC will be responsible for reviewing the data and for making a determination of whether or not it meets the threshold for taking action. If the data indicates that action should be taken, the THSP and SSC will formulate recommendations and then present them to the Unified Command. The exact protocols for data collection, analysis and delivery shall be captured in the air monitoring plan section of the ISB operations plan.

At the end of the operation, a verbal debrief should be conducted and data downloads from the monitoring instruments, as well as a printout of any hard copy reports, should be provided to the FOSC. In addition, any copies of the ISB Monitor Recorder Sheets (Attachment 8 of the SMART (series), Vol. 8, 2006) (see SMART Protocols) should be provided. The FOSC shall ensure that all data and reports are collected and properly archived by the Documentation Unit.

5. Exposure Limits for Emissions

Figure-3 outlines some of the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limits (PEL) for potential ISB hazards. The details provided here are intended to inform only and should not be interpreted as requirements for air monitoring.

Type of Hazard	Hazard Description	Exposure Limits	Symptoms of Over Exposure
Particulate Matter < 10 microns (PM_{10}): Particulates less than 10 microns (millionths of a meter) in diameter can reach the deep portion of lungs (the critical gas exchange area) and become a burden on the respiratory system. Thus the air quality standards are expressed as a fraction of particulates smaller than 10 microns in diameter.	The median size of particulates in the smoke from oil fires is 0.5 microns, posing a definite hazard to respiration. Studies show that ground-level concentrations of PM_{10} nearby in-situ burn events usually remain below safety levels (except for the area directly in the smoke plume). For most individuals, exposure to inert particulates becomes a problem only at high concentrations. However, some individuals may develop problems at levels much lower than that.	OSHA PEL: 15 mg/m3 total particulate 8 hour mean. 5 mg/m3 respirable particulates (PM_{10}) 8 hour mean	Excessive PM_{10} will burden the respiratory tract and cause breathing difficulties.
Polycyclic Aromatic Hydrocarbons (PAH): A group of hydrocarbons found in both unburned oil and the smoke plume. PAH's have very low vapor pressure, and most are not very flammable. In ISB PAH's adsorb to particulates. Studies show that concentrations in the smoke remain below exposure limits.	Some PAHs are suspected carcinogens over a long-term exposure: the target organs being the skin and lungs. The hazard is minimal in ISB events. Because of the high temperatures most PAHs are burned in the combustion process and the concentration is usually higher in the oil than in the smoke.	OSHA PEL: 0.2 ppm for 8 hours (for volatile PAH)	None. (Suspected carcinogen).
Carbon Dioxide (CO2): Colorless, odorless gas produced by burning fossil fuels.	High levels CO2 may be detected at ground level.	OSHA PEL: 5000 ppm for 8 hours.	Headache, dizziness, restlessness, paresthesia, dyspnea, sweating, malaise, increased heart rate, elevated blood pressure, coma, asphyxia, convulsions.
Sulfur Dioxide (SO2): Colorless nonflammable poisonous gas with a pungent odor. The concentration emitted in a burn is directly related to the sulfur content of the oil.	Toxic gas and a corrosive irritant to eyes, skin, and mucous membranes by forming sulfuric acid on these moist surfaces. The gas may reach the deep portion of the lungs. Studies indicate SO2 emissions remain below exposure limits during ISB events.	OSHA PEL: 2 ppm for 8 hours	Irritation of eyes, skin, mucous membranes, and respiratory system.
Nitrogen Dioxide (NO2): Toxic gaseous by product of oil combustion. It is normally a red-brown gas with an irritating order.	Extremely toxic to humans by inhalation. It is less soluble than sulfur dioxide. It can reach the deeper portions of the lungs. Small concentrations can cause pulmonary edema, which can be delayed. NO2 is also a strong irritant to eyes and respiratory and respiratory tract. Studies of ISB events have shown that concentrations of NO2 in smoke emissions remain below 0.02 ppm.	OSHA PEL: 1 ppm for 8 hours.	Irritation of eyes, skin, and mucous membranes.
Carbon Monoxide (CO): Product of incomplete combustion of oils. It is a colorless, odorless gas that is toxic to humans.	The toxicity of CO is acute, it has a high affinity to hemoglobin in the blood, displacing oxygen. The hazard of carbon monoxide from burn emissions is minimal. Data so far suggest that concentrations in oil fire smoke remain below exposure limits.	OSHA PEL: 35 ppm for 8 hours	Headache, nausea, dizziness, confusion, at high concentrations asphyxia and death.

Figure-3: OSHA PEL for potential in-situ burn hazards.

6. Heat Related Hazards

It is no surprise that ISB operations produce large amounts of heat; this heat enters the environment through the processes of convection and radiation. Roughly 90% of the heat from a burn will be convected into the atmosphere, with the remaining heat being radiated out from the fire in all directions. Radiated heat can cause a variety of issues and burns to unprotected or exposed skin. A conservative safe approach distance to an ISB operation is generally considered four times the diameter of the fire (i.e. fire diameter 30 feet = 120-foot safe approach distance). Safe approaches can be made closer, but should only be made for very short periods of time, generally less than five minutes.

Burns. Serious burn hazards will exist during any ISB operation. All potential hazards should be identified and mitigated prior to burn's ignition. Although safe practices should eliminate the possibility of a responder getting burned, contingencies for such an event should be planned for within the site safety plan (identification of closest burn unit/trauma center, etc.).

Heat Proximity. Any personnel assigned to maintain fire boom or serve as a part of the fire suppression team will be running a greater risk of exposure to heat. Great care should be taken to minimize the time these personnel spend close to the fire. Those personnel assigned to vessels responsible for towing fire boom in a "U" configuration are also at elevated risk due to their fixed position to the fire. Exposure of these personnel to uncomfortable or dangerous levels of heat should be minimized by establishing a tow length of least five fire diameters.

Heat Stress. The combination of hot, humid weather and heat radiation can pose potentially dangerous situations for response personnel. Heat can promote accidents due to slippery palms, dizziness, and lower mental alertness. To avoid heat stress, ensure responders are provided regular breaks out of the sun and have access to plenty of cold liquids, preferably water.

Heat Exhaustion. This condition is caused by the loss of large amounts of body fluid and electrolytes through sweating. A victim suffering heat exhaustion will usually still sweat, but may experience weakness, fatigue, muscle cramps, nausea, or headaches. Severe cases may see vomiting or unconsciousness. Treatment requires rest in a cool place and the intake of liquids (caffeine-free) such as sports drinks and water.

Heat Stroke. This very serious condition occurs when the body's temperature regulatory system fails and sweating becomes inadequate. A heat stroke victim's body temperature may be 105°F or higher, and they may be mentally confused or unconscious. Unless the victim receives quick treatment, brain damage and/or death may occur. First aid should be rendered immediately with the intent of lowering the victim's body temperature. Move the person to a cool area, thoroughly soak the clothing with cold water, actively fan the victim and ***seek immediate medical attention***.

7. State of Louisiana Requirements

The Louisiana Department of Environmental Quality has regulatory requirements which need to be considered when planning for an in-situ burn operation. The following excerpts are from the Louisiana Code 33:III §1109 Control of Air Pollution from Outdoor Burning.

1. **LAC 33:III §1109 Subsection D** - *Exceptions to Prohibition against Outdoor Burning*. Outdoor burning of waste material or other combustible material may be conducted in the situations enumerated below if no public nuisance is or will be created and if the burning is not prohibited by and is conducted in compliance with other applicable laws and with regulations and orders of governmental entities having jurisdiction, including air control regulations and orders. The authority to conduct outdoor burning under this regulation does not exempt or excuse the person responsible from the consequences of or the damages or injuries resulting from the burning.

2. **LAC 33:III §1109 Subsection D.8.** - ...outdoor burning of waste hydrocarbon products (from petroleum exploration, development or production operations, natural gas processing, such as, but not limited to, basic sediments, oil produced in testing an oil well, and paraffin) may be conducted at the site of origin when it is not practicable to transport the waste products for sale or reclamation, or to dispose of them lawfully in some other manner. In addition, hydrocarbons spilled or lost from pipeline breaks or other transport failure which cannot practicably be recovered or be disposed of lawfully in some other manner may be outdoor burned at the site where the spill occurred or at another appropriate place due to safety considerations. Except when the immediate or continuous burning of hydrocarbon spills is reasonably necessary to abate or eliminate an existing or imminent threat of injury to human life or significant damage to property, the outdoor burning shall be conducted under the following conditions:

   a. the location of the burning must not be within or adjacent to a city or town or in such proximity thereto that the ambient air of the city or town may be affected by smoke from the burning;
   b. the burning is conducted only between the hours of 8 a.m. and 5 p.m.; and
   c. the burning is controlled so that a traffic hazard as prohibited by Subsection E of this Section is not created; and...

3. **LAC 33:III §1109 Subsection E** - *Traffic Hazards Prohibited*. The emission of smoke, suspended particulate matter or uncombined water or any air contaminants or combinations thereof which passes onto or across a public road and creates a traffic hazard by impairment of visibility, as defined in LAC 33:III.111, or intensifies an existing traffic hazard condition is prohibited.

4. **LAC 33:III §1109 Subsection F** - *Exclusion from Application of this Section*. Outdoor burning pursuant to and in compliance with the terms of a variance granted by the administrative authority is excluded from the application of this Section.

8. State of Texas Requirements

The Texas General Land Office should be contacted to determine if there are any state or regional regulatory requirements which will need to be considered when planning an in-situ burn operation.

APPENDIX E
Post Burn Reporting Requirement

Once burn operations have concluded, a post burn report is required to be completed and returned to RRT-6. This report can be found in the following form; this ***shall*** be filled in by the FOSC, or designated representative, and sent to the Eighth Coast Guard District's RRT-6 Co-Chair and RRT-6 Coordinator via email.

Post Burn Report Form
Method of ignition; include amount & type of burning agents employed (if used): *(Character limit: 300)*
Number burns conducted; include the duration & amount of oil burned for each: *(Character limit: 300)*
Air monitoring results; highlight instances where Level of Concern and other action level thresholds were exceeded: *(Character limit: 300)*
Overall effectiveness of the burn(s); describe any follow on actions (residue recovery, post burn monitoring, etc.): *(Character limit: 600)*
Any significant operational departures from the burn plan approved by the FOSC: *(Character limit: 500)*
Any lessons learned, best practices, or recommended process improvements for future response: *(Character limit: 600)*

Along with this report, please include a few digital pictures of the burn operations as attachments; additional details about the burn operation, outside of those requested in this form, are not required by RRT-6. The Eighth Coast Guard District's RRT-6 Co-Chair and Coordinator will ensure this report's further distribution as appropriate.

A fillable PDF of this template can be found at: Appendix E - Post Burn Report

APPENDIX F
In-Situ Burn Exclusion Zones for the Offshore Environment

There are some designated exclusion zones within Region 6 where burning agent and ISB use are prohibited; these areas are generally offshore and consist of natural banks, hard bottom habitats, artificial reefs, shoals and an area off of Grand Isle, Louisiana. The specific latitude and longitude for each individual zone may be found in Appendix E of the RRT-6 In-Situ Burn Plan (see Region 6 ISB Plan).

These zones may also be referenced graphically through NOAA's Environmental Response Management Application (ERMA) for the Gulf of Mexico (see ERMA GOM). ***Note: Internet Explorer is not compatible with ERMA. Please use Google Chrome or Microsoft Edge.***

To view the "RRT-6 In-Situ Burn Exclusion Zones" layer in ERMA, select the following:

1. Response Planning
2. Area Contingency Plans
3. Sectors Corpus Christi & Houston/Galveston
4. In-Situ Burn Exclusion Areas (TGLO)

APPENDIX G
Deepwater Horizon Lessons Learned

On April 20th, 2010 the Mobile Offshore Drilling Unit DEEPWATER HORIZON, located in the Mississippi Canyon block 252 approximately 42 miles southeast of Venice, Louisiana, experienced a catastrophic explosion and fire resulting in the deaths of 11 persons on board. What followed this tragic event was the eventual discharge of over 200 million gallons of oil, making it the largest spill in American history. The following months long oil pollution fight severely tested the nation's capability and capacity to mitigate the oil's impact, requiring each and every response tool available. In addition to mechanical recovery and dispersants, these tools frequently included the use of the In-Situ Burn (ISB) technique.

Between April 28th and July 19th, there were a total of 411 controlled ISBs conducted, burning over 11.1 million gallons of oil or roughly 5% of all oil discharged during the incident. Although the RRT-6 In-Situ Burn Operations Plan had been signed and in place since 1994, this extended response represented the first and only time that the ISB technique has been employed in the offshore, coastal zone within the RRT-6 area of responsibility. The large number of burns combined with the challenges faced by these responders yielded valuable takeaways and best practices for those who would conduct future ISB operations in the offshore environment.

Establishment of the Controlled In-Situ Burn (CISB) Group.

Due to the sheer size and continuous release of the discharge, it became clear early on that initial skimming assets were not going to be sufficient to contain and collect the surface oil. Less than one week after the initial incident, the use of the ISB technique as an additional response tool was proposed. Before the start of burn operations, the oil was sent to a laboratory for analysis and test burns were conducted. The results confirmed that the oil was suitable to support ISB operations. Once this determination was made, the Controlled In-Situ Burn (CISB) Group was created under the Offshore Operations Branch supporting the Incident Command Post in Houma, LA. There were no inshore/nearshore ISB operations conducted during the Deepwater Horizon response.

While it started as a five-person team, the Group eventually grew to employ over 260 responders. At its peak of operations, the Group consisted of three task forces, utilizing over 40 vessels and two twin-engine spotter aircraft. Each task force was assigned a three-vessel ignition team, a supply vessel, a safety team, and five two-vessel fire boom teams.

Each day of operations, a CISB Burn Area would be established as the designated zone for ISB activities; this area would be located wherever the greatest concentrations of burnable oil could be found, generally three to eight miles from the spill source. To

prevent ISB operations from interfering with the source control vessels, no ISBs were permitted closer than three miles to where the source control efforts were taking place. The CISB Burn Area first started as a box however over time, this was replaced by a burn circle. This allowed CISB Task Forces to cover greater areas because their vessel's turning radius conformed better to a circular rather than a box shaped pattern.

Operations Overview

Before starting operations, all personnel were provided just-in-time training consisting of four hours classroom and 12 hours on-water instruction. Some teams were also provided underway practice days if it was deemed necessary.

In a typical day, safety and air monitoring personnel would man a lead boat out in front of the fire boom teams. With the exception of when the weather was adverse, the CISB Group Task Forces and support vessels would be on location within the designated CISB Burn Area at daybreak. Spotter aircraft would then fly and begin to guide fire boom teams to the heaviest concentrations of oil.

Two spotter aircraft were available to provide continuous air observation during ISB operations. To facilitate identification and communication with the aircraft, fire boom teams would mark their vessels using colored tarps suspended over the back deck of their boats. Additionally, the CISB Group would use the Automatic Identification System (AIS) to identify the ISB operation vessels and confirm their positions to the aircraft. In an effort to extend ISB operations, the spotter aircraft attempted to fly soon after sunrise as well as into the late afternoon as the sun was beginning to set. The CISB Group learned that the angle of the sunlight was the determining factor when it came to spotting oil; the low angle of the sun during these early and late flying times was found to not to be conducive to spotting oil and so instead concentrated on providing coverage when the sun was further up, off the horizon.

Once all assets were on station, aircraft would begin vectoring fire teams to the oil. A log of events (times of arrival and departure for the spotter aircraft, times of ignition, durations of burn, etc.) was kept on the ICS-214 form by the Task Forces for each burn day. As the fire boom vessels moved through heavy patches or long streamers of oil they would be lit by an ignition team once a sufficient amount had been collected and contained within the boom. As collection and burning efforts continued, there was a general concern that the fire could travel up the boom toward the towing vessels. Careful monitoring and regulation of towing speeds ensured the fire stayed well within the towed boom configurations. At times, burns extended outside the fire boom containment, but were allowed to continue to burn because they would not spread significantly. By late July 2010, crews were finding that the oil was more weathered and ignition was becoming more difficult. To counter this, crews began towing existing oil fires into emulsified oil patches in an effort to ignite it; this technique proved relatively successful. The CISB Group had their best burns on June 18, 2010. A total of 16 different burns were conducted with roughly 2.5 million gallons of oil consumed. The seas were unusually calm that day, which provided optimal conditions for

collection/burning.

During the course of the 411 burns at sea, responders only intentionally extinguished two of them. The first occurred at the end of the longest recorded burn; after over 11 hours of continuous burning, a fire boom crew was continuing to catch oil and feed it into the fire, however the personnel were beginning to demonstrate signs of fatigue. Out of concern for the safety of the crew, the decision was made to discontinue to the burn. In order to extinguish the burn, the crew increased towing speed, which forced the oil under the boom. This thinned the oil out reducing vapor availability, and caused the fire to extinguish. The second occurred when a very large fire spilled out of the pocket of a fire boom and continue to grow in size and intensity while moving across the three-mile buffer zone surrounding the source control efforts. The source control vessels voiced concern that the fire was perhaps coming too close, so out of an abundance of caution, it was extinguished.

Wildlife Monitoring

While burning effectively removed large amounts of oil, there were potential trade-offs with respect to impacts to wildlife, particularly turtles. To reduce the likelihood of turtle impacts, trained and qualified protected species observers were placed within each CISB Task Force to monitor for sea turtle presence in the fire boom. While present with the fire ignition teams, observers did not spot turtles in or near fire boom.

Fire Boom Requirements & Performance

As the CISB Group continued to grow, so too did their resource requirements. At the peak of operations, the fire boom teams required approximately 10,000 feet of fire boom to be available at all times. As various types of fire boom were being put to the ultimate test, different designs were proving more effective than others. Fire boom which had continuous inflation chambers would sink on occasion and were determined to be a potential safety risk. The three primary types of fire boom used were water-cooled boom, stainless steel float boom, and ceramic boom. These boom types performed as advertised and generally would last well beyond their expected service life. Throughout the response, the CISB Group was generally replacing about 400-500 feet of fire boom each day. It was found that the single most destructive action a crew could take on fire boom (of any style or design) would be to remove/lift it from the water using a crane. The stresses inflicted on the boom by lifting it this way would usually result in it being damaged beyond repair.

Simultaneous Operations

The Offshore Operations Branch of ICP Houma managed an integrated response far offshore using mechanical skimming, aerial dispersants, and the CISB Group. To manage these simultaneous operations safely the *M/V SEACOR LEE* was designated as a command and control vessel. The presence of this vessel helped to coordinate

removal operations between Groups and allowed for more clear communications between the offshore vessels, aircraft and the Command Post.

Air Monitoring

Early on in the response, NOAA personnel in the CISB Group worked with the National Atmospheric Release Advisory Center (NARAC) to model potential plume releases from ISB. Based on those results, and given the distance at which ISB operations were going to be taking place offshore, it was determined that land-based general population centers would not be at risk from smoke plume impacts. Additionally, during initial test burns, SMART monitoring protocols were put into place by NSF personnel on an offshore platform approximately 13 miles southwest of the planned burn site (nearest location of non-response personnel). The monitoring revealed no detectable particulates and so SMART monitoring protocols were not required in this area, or on shore (35+ miles away), during further burns.

SMART monitoring protocols were put into place for those vessels conducting the burns however. It was found that response vessels downwind from a plume easily removed themselves from paths of exposure, and the collected SMART monitoring results indicated no particulate exposures to CISB Group personnel. Air monitoring equipment early on did pick up readings of particulates when it was placed next to those pumps being used to cool the water-cooled fire boom. This situation was easily remedied by moving the pumps from the front of the vessel, where the monitoring gear was, to the rear. The U.S. Coast Guard was also directed to conduct air sampling for dioxin, a known carcinogen and potential byproduct of the burning operations. With the assistance of the Environmental Protection Agency, extensive sampling for this substance was performed. These air monitoring results indicated no dioxin threat or exposure to the responders.